Remnant vegetation, priority flora and weed invasions at Yilliminning Rock, Narrogin, Western Australia

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Abstract

Remnant vegetation on and around Yilliminning Rock, a granite inselberg near Narrogin, Western Australia, was surveyed several times between 1992 and 1997. Six plant communities comprising 238 vascular species from 54 families are reported. These include 2 undescribed species and 5 priority species; many of these populations are reported for the first time. In addition to the diverse vascular flora, 33 species of lichens from 11 families, including 2 priority species, are recorded for Yilliminning Rock. Of 19 recorded introduced vascular species, several are serious environmental weeds. The weed threat to populations of priority species and other management issues of concern are discussed.

Introduction

Yilliminning Rock is located in the Shire of Narrogin, about 230 km south-east of Perth, on the western edge of the Western Australian wheatbelt (Fig 1). The rock is a granite inselberg, rising to approximately 48 m, with commanding views across the farmland and remnant vegetation of the surrounding agroecosystem. Yilliminning Rock is a prominent feature in an undulating transitional landscape; less dissected and with fewer large granite outcrops than the Pingelly district to the north (Beard 1980). This contrasts the flat landscape to the southeast that includes the extensive wetlands of the Northern Arthur River System.

Beard (1980) describes the vegetation type around Yilliminning Rock as York gum (*Eucalyptus loxophleba*) and wandoo (*E. wandoo*) woodlands with some heath vegetation dominated by *Dryandra* species. However, this is more typified by remnant vegetation at Birdwhistle Rock about 20 km to the north-east. Here there is also rock sheoak (*Allocasuarina huegeliana*) forest, but with less prominent granite outcropping and a more visible disturbance history (*e.g.* stock grazing) and weed invasion than is apparent at the Yilliminning Rock reserve. The remnant woodlands and heaths around Yilliminning Rock have more in common with the vegetation types described for the Dryandra Forest to the northwest (see Coates 1993), although there are no large granite outcrops there. In fact, most of the granite outcrops mapped in the area by Beard (1980) have been cleared, with the exception of a small remnant about 10 k to the south near Nomans Lake (*unpublished observations*).

Yilliminning Rock occurs on a reserve of 86 ha, vested in the Shire of Narrogin as an A Class Reserve (11016) in 1960. The reserve was originally set aside for water and recreation in 1906, when the area was first surveyed for agriculture. Yilliminning Rock is surrounded by about 60 ha of remnant heath and woodlands to the north and west and bordered by farmland on its east side (Fig 2). The Harrismith Road, which runs along the southern edge of the rock, provides access for the steady number of visitors from the town of Narrogin, 17.5 km to the west. Spectacular views in all directions are found at the top of Yilliminning Rock, which takes about 10 minutes to climb. With abundant wildflowers in winter and spring, the bushland at the base of the rock provides an attractive setting for picnics and walks.

This paper primarily describes the vegetation and flora of Yilliminning Rock and adjacent remnant vegetation. Secondly, it discusses the current threats to the nature conservation values of the remnant vegetation, as a basis for future management.

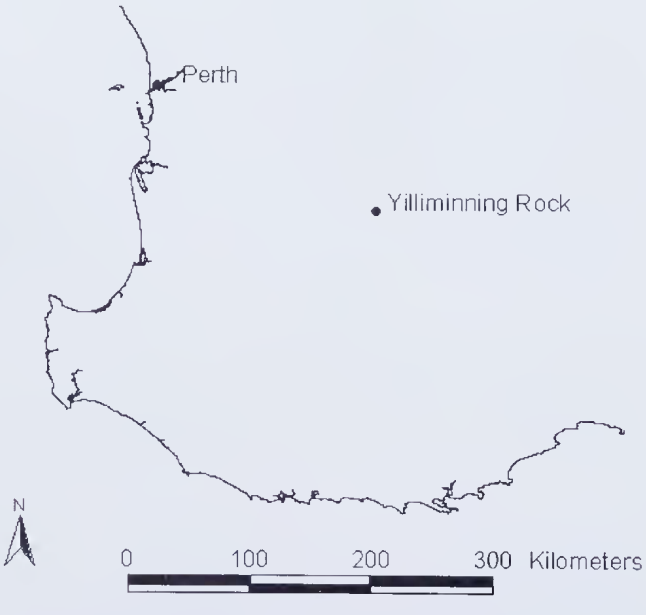

Figure 1. Location of Yilliminning Rock near Narrogin in the south-west of Western Australia.

Granite Outcrops Symposium, 1996

Figure 2. Aerial photograph of Yilliminning Rock Reserve, near Narrogin, Western Australia.

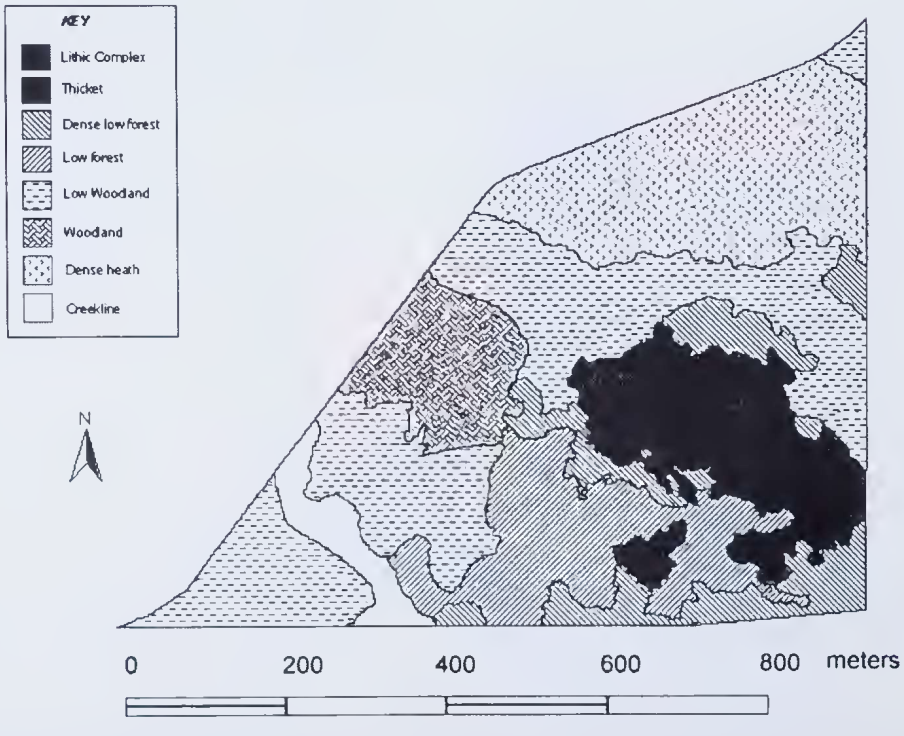

Figure 3. Vegetation map for Yilliminning Rock Reserve with vegetation associations from Table 1 shaded as Lithic Complex (1), Thicket (2), Dense Low Forest (3a). Low Forest (3b), Low Woodland (4), Woodland (5) and Dense Heath (6). The creekline running across the southwest of the reserve is unshaded.

Materials and Methods

Vegetation at Yilliminning Rock was mapped from a 1972 aerial photograph (Fig. 2) and 1996 remotely sensed image data (*unpublished data*). Associations and ecotone boundaries were checked during field surveys in 1996 and 1997. A list of species for Yilliminning Rock was compiled from records of the WA Herbarium (WAHERB) and collections made in spring 1992 (Anon 1993) and 1996 and autumn 1997. The survey technique known as 'randomized stratified walk' (Hopper *et al.* 1997) was used to sample each of the observable vegetation associations. This included a detailed circumnavigation of apron vegetation around Yilliminning Rock and several systematic traverses over the top of the rock.

Vegetation classification of associations follows Muir (1977). The authors identified specimens with assistance from staff of the WA Herbarium and S Hopper, Director of the Kings Park and Botanic Gardens. Nomenclature follows WACENSUS (WA Herbarium census of Western Australian vascular plants) and conservation status of species assigned from Atkins (1996) according to the following definitions (Table 1).

Table 1

Categories of Priority Flora according to the degree of perceived threat.

Category	Definition
Priority One – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations which are under threat.
Priority Two – Poorly Known Taxa	Taxa which are known from one or a few (generally <5) populations, at least some of which are not believed to be under immediate threat *i.e.* not currently endangered.
Priority Three – Poorly Known Taxa	Taxa which are known from several populations, at least some of which are not believed to be under immediate threat *i.e.* not currently endangered.
Priority Four – Rare Taxa	Taxa which are considered to have been adequately surveyed and which, while being rare (in Australia), are not currently threatened by any identifiable factors.

Results and Discussion

Vegetation associations

Six vegetation associations, including canopy cover variations for 1 of these, were mapped for the Yilliminning Rock reserve (Fig 3). A seventh category, described as a degraded creekline, was also mapped. A description of each association and variants were made and important structural species and generalised understorey descriptions noted (Table 2).

Table 2

Vegetation associations at Yilliminning Rock, including variations and important species.

1: Lithic Complex (granite rock)	*Kunzea pulchella, Pimelea graniticola, Borya sphaerocephala, Cheilanthes* spp and many herb species.
2: Thicket (granite apron)	*Acacia lasiocalyx, Calytrix leschenaultii, Dodonaea* spp, *Dryandra* spp and other shrub species.
3: a, Dense low forest and b, Low forest (granite perimeter)	*Allocasuarina huegeliana* with scattered *Acacia acuminata, A. saligna* and *Eucalyptus wandoo,* with shrub and herbaceous understorey species.
4: Low Woodland	*Eucalyptus wandoo* with scattered *Acacia acuminata* and sparse, open shrub understorey.
5: Woodland	*Eucalyptus salmonophloia* with sub-shrub and herbaceous understorey species
6: Dense heath	*Dryandra* spp, *Melaleuca* spp, *Isopogon teretifolius* with other shrub and herbaceous species.
7: Creek line	Degraded; dominated by *Ehrharta calycina*

Vegetation on Yilliminning Rock is not uniformly distributed; the shape and slope of the rock are different on all sides. Vegetation usually only associated with granite outcrops occurs on the west side (Association 2; Table 2) dominated by a diversity of flowering shrubs (*e.g. Dryandra* and *Dodonaea* spp) and sedges (*e.g. Lepidosperma* spp). Crevice and meadow vegetation, also endemic to granite outcrops in the southwest of Western Australia, is scattered across the rock. Steeper parts of the north and western slopes are the exception to this. Distinctive endemics, such as *Kunzea pulchella* and *Baeckea camphorosmae* and *Cheilanthes* ferns, grow in rock crevices (Association 1). Small meadows are also found on Yilliminning Rock comprising *Borya sphaeocephala* and herbaceous endemics such as *Thelmytra antennifera, Leporella fimbriata, Crassula* spp and *Levenhookia* spp (see also Appendix 1).

Allocasuarina huegeliana forest (Association 3; Table 2) clothes the southern face of Yilliminning Rock to the road to the top (Fig 2). The understorey is primarily herbaceous due to the copious needle litter produced by this tree species. Most notable in this association are 14 species of orchids and numerous species of everlastings. This dense forest association is also found on the northeast side of Yilliminning Rock (Fig 3) where it forms an impenetrable forest with *Acacia saligna* and *Xanthorrhoea brunonis*.

A small but distinctive pocket (about 10 ha) of salmon gum woodland (Association 5; Table 2) lies between the wandoo woodland (Association 4) and rock casuarina forest (Association 3a & 3b; Fig 3). Salmon gum woodland is poorly represented in conservation reserves in the area and this remnant contributes greatly to habitat values of the reserve.

Heath (association 6; Table 2) occupies the northern part of the reserve (Fig 3). It is an important connection to heath on the other side of Birdwhistle Road (Reserve 13343) (Fig 2) and Nature Reserve 17115, approximately 2 km to the northeast.

The creekline (category 7) runs across the southwest of the reserve. It seems not to be degraded native creek vegetation as at other remnants east of the reserve (*unpublished data*) but a drainage channel. *Ehrharta calycina* (veld grass) and *Chenopodium album* (fat hen) dominate the creekline.

Regardless of this, seasonal inundation of stormwater from adjacent farmland, including high levels of nutrients, favour agricultural weeds (*e.g.* veld grass) which largely replace native species in these low-lying areas.

Flora

Species richness. Granite outcrops in south-west Western Australia are local centres of plant diversity, with high endemism (Hopper *et al.* 1997). Yilliminning Rock fits this model with a high number of species recorded and several known threatened taxa. Appendix 1 lists 238 vascular plant species, including 219 native species, compiled from all vegetation associations (Table 2). Fifty-four families are represented in the list. Appendix 2 lists 33 species of lichens representing 11 families. This diversity of species and communities is high when compared to other woodland reserves in the district (*unpublished data*). Highest numbers of species were recorded from the granite rock crevice, meadow and fringing plant communities, although woodland species are well represented in the species list (Appendix 1).

The seven best represented families at the Yilliminning Rock Reserve (see Appendix 1) were Proteaceae (21), Orchidaceae (19), Asteraceae (17) Myrtaceae (17), Poaceae (16), Papilionaceae (13) and the lichen family Parmeliaceae (16). Genera with the highest number of species were *Acacia* (8), *Hakea* (8), *Dryandra* (6) and *Caladenia* (6) and the lichen genera *Xanthoparmelia* (7).

Priority species. Many populations of priority taxa (Table 1) in the southwest of Western Australia are found outside conservation reserves (Coates & Atkins 1997), and Yilliminning Rock highlights this. Five priority taxa of vascular plants and 2 priority lichens are known to occur in the reserve, as well as species of *Boronia* (*B.* aff *subsessilis*) and *Melaleuca* (aff *scabra*) that are undescribed (see Appendix 1).

• *Caladenia integra*. Priority 4. *C. integra* is known from scattered populations between Tenterden in the south and Clackline in the north, with a disjunct occurrence near Kalbarri (Hoffman & Brown 1992). The southern populations seem to be confined to dense rock sheoak woodlands on and around granite outcrops. *C. integra* was collected (LWS 738) from low sheoak forest (Fig 3) on the reserve in 1996 where it was found to be common.

• *Dryandra fasciculata*. Priority 3. *D. fasciculata* is only known from a few collections in the southern wheatbelt shire of Kulin and further south at Nyabing. A collection was made from a small population in 1996 (LWS 846) in thicket at the base of Yilliminning Rock (Fig 3). The occurrence of this species at Yilliminning Rock extends its known distribution westward by approximately 60 km.

• *Dryandra meganotia*. Priority 3. *D. meganotia* (syn *D. serratuloides* subsp *meganotia*) was recorded from heath on the reserve in 1981 by D Hart (then Department of Fisheries and Wildlife). Since then it has been collected by G Durell in 1995 (GD 98) and by the authors (LWS sn) This species was also found in heath on the adjacent Reserve 13343 (Fig 2). These populations extend the range of *D. meganotia* west, previously only reported from between Kulin and Nyabing (George 1996).

• *Pimelea graniticola*. Priority 2. *P. graniticola* occurs only on granite outcrops, in soil pockets over granite sheets (Rye 1988). The authors, with S Hopper, collected from 2 new populations (LWS 719 & 840) on Yilliminning Rock in October 1996, each comprising of over one hundred plants, extending the known range west by about 100 km.

• *Stylidium tenuicarpum*. Priority 4. *S. tenuicarpum* is known only from Tutanning Nature Reserve east of Pingelly and the immediate area (Carlquist 1969). The authors, with S Hopper, discovered a new population (LWS 842) on Yilliminning Rock in October 1996.

Lichens. As with other granite outcrops in the wheatbelt, Yilliminning Rock is an important centre of diversity for lichens. A total of 33 lichens, belonging to 11 families have been recorded from the rock. These include 31 species recorded in the Western Australian Herbarium's database WAHERB from a collection made by N Sammy in October 1981 (Appendix 2). Two additional species, *Paraparmelia sammyi* and *P. sargentii* have been recorded by Elix & Johnston (1988) and are listed by the Department of Conservation and Land Management as Priority 2 threatened flora.

Introduced weeds. Only 19 species or 8% of the flora at Yilliminning Rock reserve are introduced weeds. This is lower than ratio's for other remnant woodlands in the area (*unpublished data*). However, many of these are cosmopolitan environmental weeds, some dense in various habitats at Yilliminning Rock, which pose a significant threat to native species and plant communities. The major weeds recorded at Yilliminning Rock are *Avena fatua, Briza maxima, Ehrharta longiflora, E. calicyna, Freesia leichtlinii* x *alba, Hypochoeris glabra, Romulea rosea* var *australis* and *Ursinea anthemoides*.

The worst of these is *Freesia leichtlinii* x *alba*, first recorded in 1992 by one of the authors (JPP) at the base of Yilliminning Rock and observed the following year in a crevice on top of the rock. It appears to have invaded from the settlement on the east side Yilliminning Rock (Fig 2) and has now spread through all crevice and meadow vegetation there. Of particular concern is the threat to the newly recorded populations of *Pimelea graniticola*. The latter species appears to be an obligate seeder, adapted to a reduced disturbance habitat with minimal competition for resources. The rapid and overwhelming invasion by *Freesia leichtlinii* x *alba* must eventually have a detrimental effect on the recruitment and survival patterns of this and other native species growing in the crevice and meadow communities.

Management issues

Access. There are many management issues at Yilliminning Rock common to most other wheatbelt granite outcrops (see Main 1997) that need to be

addressed. The most significant issues are the control of public access and weeds. Whilst there is no doubt about the importance of public access to the top of the rock, assessment of the current situation is needed to halt the continuing damage to the western face of the rock. Timber has been cut from woodlands in the reserve but some time ago (Anon 1981).

At present, the public is allowed access to the western side of Yilliminning Rock along a graded track from Birdwhistle Rock Road (Fig 2). A small area at the end of this track allows for vehicle turnaround and parking at the base of the rock. A wide and well-worn path is visible up the rockface at this point. Damage over a wide area is a consequence of loose rock being removed or smashed over time. Most lichens and mosses are gone on this part of Yilliminning Rock (Fig 2) and the few meadows left are degraded and weedy. There is also some broken glass and litter about the entry to the rockface from the carpark. A wildfire in 1990, presumably deliberately lit because of its origin and spread, has resulted in weed invasion in this area.

There is also unwanted access off the main entry track north to another part of the rock some 100 m around from the main carpark. Other undesirable car tracks lead north and south from the main track. Salmon gum and wandoo woodland herbfields and soils are sensitive to this kind of damage and it may take years for vehicle tyre marks to disappear. These tracks needed to be closed off with barriers, augmented by the planting of local trees.

Weeds. Weeds invade in response to disturbance and altered environmental conditions. The 1990 wildfire burnt most of the vegetation around the apron on the west side of Yilliminning Rock. Although resprouters dominate these communities, the disturbance allows weeds to establish, particulary in the meadows at the base of the rock and the more open areas of rock casuarina woodland. The common bushland weeds *Hypochoeris glabra* and *Ursinea anthemoides* are prominent here. Another weed, the small sedge *Juncus bufonius*, is common in the granite rock meadows and threatens the stability of this community because of its dense soil seed-bank (*unpublished data*). The most serious weed, *Freesia leichtlinii* x *alba*, has spread rapidly since the early 1990's into much of the low forest and crevice plant communities on the east side of Yilliminning Rock. Immediate measures to control this aggressive weed and monitor its impact on populations of *Pimelea graniticola* are required.

Excess water runoff, which often includes fertilizer from nearby agricultural areas, also provides suitable conditions for weed invasion (Hobbs 1991). One such area, the creekline vegetation in the southwest of the reserve (Fig 3), is infested with grass weeds (*e.g. Ehrharta calycina*). Likewise, the open area at the foot of the northeastern face of Yilliminning Rock, is also heavily infested with grass weeds (*e.g. Avena fatua* and *Bromus diandrus*). This area has been disturbed by unwanted vehicle access also receives high runoff from the steepest part of Yilliminning Rock in winter. Grass weeds at these sites could be controlled with selective herbicides.

Conclusions

Yilliminning Rock is an important local remnant with a broad diversity of habitats and a relatively high level of species richness in vascular plants and lichens. It therefore has high nature conservation value, providing an important link between larger nature reserves to the northeast and the chain of wetland reserves and farm remnants to the southeast, many of which are degraded. The rock itself is of great significance because of its large size and good condition compared to the many degraded granite outcrops on farms in the area, including the nearby Birdwhistle Rock reserve.

A management plan is needed to assist the Narrogin Shire in directing future management Yilliminning Rock (see Anon 1995). Major problems such as access and weed invasion should be addressed. This could be done in as joint consultative project involving the shire, the Department of Conservation and Land Management, the Land Conservation District Committee and other community groups. Part of this process could include public education about ecological issues and the recreation in the Narrogin area, resulting in better management of other remnants.

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Appendix 1

Vascular plant species at Yilliminning Rock Reserve listed by family and with vegetation association from Table 2 and Fig 3; Lithic Complex (1), Thicket (2), Dense Low Forest (3a), Low Forest (3b), Low Woodland (4), Woodland (5) and Dense Heath (6). Introduced species (mostly invasive weeds) are marked *.

Family & species	Vegetation Association
ADIANTACEAE	
Cheilanthes austrotenuifolia H Quirk & TC Chambers	1
C. distans (R Br) Mett	1
C. sieberi Kunze subsp *sieberi*	1
ASPLENIACEAE	
Pleurosorus rutifolius (R Br) ex Benth	1
JUNCAGINACEAE	
Triglochin calcitrapa Hook	1
POACEAE	
**Aira caryophyllea* L	1,2–3
Amphipogon strictus R Br	3,4
A. turbinatus R Br	3,4
Austrostipa elegantissima (Labill SWL) Jacobs & J Everett	1,2–3,4
A. semibarbata Labill	5
**Avena fatua* L	1,2,3
**A. sativa* L	2–3
**Briza maxima* L	1,4
**B. minor* L	1,4
**Bromus diandrus* Roth	1
**Ehrharta calycina* Smith	4 & creekline
**E. longiflora* Smith	4
**Lolium rigidum* Gaudin	2–3
Neurachne alopecuroidea R Br	2–3,6
Notodanthonia caespitosa (Gaudich)Zotov	5
Spartochloa scirpoidea (F Muell) Maiden & E Betche	1
**Vulpia myuros* (L) C Gmelin	1,4
CYPERACEAE	
Caustis dioica R Br	2–3,5
Gahnia australis (Nees) KL Wilson	2–3,5
Lepidosperma gracile R Br	2–3
L. pruinosum Kuek	6
L. resinosum (Nees) Benth	2–3,5
Mesmolaena stygia (R Br) Nees aff subsp *stygia*	4
Schoenus brevisetis (R Br) Benth	6
RESTIONACEAE	
Desmocladus flexuosa (R Br)LASJohnson & BG Briggs ms	2–3
Desmocladus sp (JPP sn)	5
CENTROLEPIDACEAE	
Aphelia brizula F Muell	2–3
Centrolepis aristata(R Br) Roemer & Schultes	2–3
Centrolepis pilosa Hieron	2–3
C. polygyna (R Br) Hieron	1
JUNCACEAE	
**Juncus bufonius* L	1
ANTHERICACEAE	
Arthropodium capillipes Endl	1,2–3
Borya sphaerocephala R Br	1, 2,3
Caesia parviflora R Br	2–3
Chamaescilla corymbosa (R Br) F Muell ex Benth	2–3,4
Laxmannia squarrosa Lindley	2–3
L. grandiflora Lindley	4
Sowerbaea laxiflora Lindley	2–3,4
Thysanotus patersoni R Br	1,2–3
DASYPOGONACEAE	
Lomandra effusa (Lindley) Ewart	5
L. micrantha (Endl) Ewart	5
L. rupestris (Endl) Ewart	3b
L. suaveolens (Endl) Ewart	4
Lomandra sp (LWS 724)	3
XANTHORRHOEACEAE	
Xanthorrhoea brunonis Endl In Lehm	2–3,6
PHORMIACEAE	
Dianella revoluta R Br	4
Stypandra glauca R Br	1,2–3
HAEMODORACEAE	
Anigozanthos humilis Lindley	2–3,6
Conostylis aculeata R Br subsp *bromeloides* (Endl) JW Green	2–3
C. pusilla Endl	2–3,4
C. setiga R Br	2–3
Haemodorum laxum R Br	2–3
H. aff *paniculatum* (JPP sn)	4
IRIDACEAE	
**Freesia leichtlinii* Klatt x *alba*	1,2,3,5
Orthrosanthus laxus (Endl) Benth	2–3
Patersonia juncea Lindley	2–3
**Romulea rosea* (L) Ecklon	1,4
ORCHIDACEAE	
Burnettia nigricans (R Br) Hopper & Brown	2–3,4
Caladenia chapmanii ms (LWS 740,742,743,744)	2–3,1,4
C. falcata (Nicholls) MAClem & Hopper	2–3
C. flava R Br	2–3,1,4
C. hirta Lindley subsp *hirta* ms (LWS 747)	4
C. integra E Coleman	2–3,1
C. longicauda Lindley subsp *eminens* ms (LWS 745)	4
Cyanicula deformis (R Br)	2–3
C. gemmata (Lindley) Hopper & Brown	1
Diuris corymbosa Lindley	2–3,4
Diuris sp (JPP sn)	2–3
Eriochilus dilatatus Lindl	5
Leporella fimbriata (Lindl) AS George	5
Pterostylis hamiltonii Nicholls	2–3
P. recurva Benth	2–3
P. sanguinea DL Jones & MA Clem	4
Spiculaea ciliata Lindley	1
Thelymitra nuda R Br	1
T. antennifera (Lindley) JD Hook	1
CASUARINACEAE	
Allocasuarina huegeliana (MlQ) L Johnson	2–3,4
A. microstachya (Miq) L Johnson	2–3,1
PROTEACEAE	
Adenanthos cygnorum Diels aff subsp *cygnorum*	6
Banksia sphaerocarpa R Br var *sphaerocarpa*	6
Conospermum stoechadis Endl subsp *sclerophyllum* (Lindl) EM Benn	2–3
Dryandra armata R Br	6

D. fasciculata AS George	2–3
D. fraseri R Br var *fraseri*	5
D. meganotia AS George	6
D. nivea (Labill) R Br subsp *nivea*	2–3
D. squarrosa R Br subsp *squarrosa*	2–3
Grevillea pilulifera (Lindley) Druce	2–3
Hakea amplexicaulis R Br	2–3
H. baxteri R Br	6
H. incrassata R Br	6
H. lissocarpha R Br	5
H. petiolaris Meissner	2–3
H. prostrata R Br	5
H. trifurcata (Smith) R Br	2–3
H. undulata R Br	2–3
Isopogon teretifolius R Br	6
Persoonia trinervis Meissner	2–3
Petrophile squamata R Br	2–3,6
Synaphea petiolaris R Br	2–3
Synaphea sp (Pieroni 14)	4
SANTALACEAE	
Choretrum glomeratum R Br var *glomeratum*	4
Exocarpos aphyllus R Br	5
Leptomeria pauciflora R Br	2–3
L. spinosa (MlQ) A DC	2–3
Santalum acuminatum (R Br)A DC	2–3
LORANTHACEAE	
Amyema miquelii (Miq) Tiegh	4,5
GYROSTEMONACEAE	
Gyrostemon subnudus (Nees) Baill	2–3
CHENOPODIACEAE	
Atriplex exilifolia F Muell	4–5
**Chenopodium album* L	4 & creekline
PORTULACACEAE	
Calandrinia calyptrata JD Hook	1
CARYOPHLLACEAE	
**Petrorhagia velutina* (Guss)P Ball	1
LAURACEAE	
Cassytha aurea JZ Weber var *hirta*	2–3
DROSERACEAE	
Drosera glanduligera Lehm	1,2–3
D. macrantha Endl subsp *macrantha*	1,4,5
D. menziesii R Br subsp *menziesii*	2,3,4
D. aff *pycnoblasta* (LWS 717)	5
D. aff *giganta* (LWS 715)	1,2–3
CRASSULACEAE	
Crassula closiana (Gay) Reiche	1
C. decumbens Thunb var *decumbens*	1
**C. natans* Thunb var *minus*	1
PITTOSPORACEAE	
Sollya heterophylla Lindley	5
MIMOSACEAE	
Acacia acuminata Benth	2–3,4,5
A. erinicea Benth	5
A. lasiocarpa var *sedifolia* (Meisn) Maslin	4
A. lasiocalyx CRP Andrews	2–3
A. microbotra Benth	3,4
A. pulchella R Br	5
A. saligna (Labill) HL Wendl	2–3
A. stenoptera Benth	4,5
Acacia sp (LWS 716)	2–3
Acacia sp (BR Maslin 6754)	4
Acacia sp (BR Maslin 6757)	6
PAPILIONACEAE	
Bossiaea eriocarpa Benth	4
Daviesia cardiophylla F Muell	2–3,6
D. hakeoides Meisn subsp *hakeoides*	2
D. preissii Meissner	2–3,5
D. uncinata Crisp	6
Gastrolobium calycinum Benth	4
G. spinosum Benth var *spinosum*	2–3,4
Gompholobium marginatum R Br	2–3,4
Isotropis cuneifolia (Smith) Benth ex BD Jackson	4
Jacksonia aff sternbergiana Huegel	6
J. eremodendron E Pritz	6
Sphaerolobium medium R Br	2–3
Templetonia sulcata (Meissner) Benth	5
GERANIACEAE	
**Erodium botrys* (Cav) Bertol	1
RUTACEAE	
Boronia sp nov LWS 836 (aff *B subsessilis*)	2–3
TREMANDRACEAE	
Tetratheca hirsuta Lindley	2–3,4
POLYGALACEAE	
Comesperma ciliatum Steetz	2–3
C. scoparium Steetz	2–3
EUPHORBIACEAE	
Poranthera microphylla Brongn	2–3
STACKHOUSIACEAE	
Stackhousia huegelii Endl	2–3
S. pubescens A Rich	2–3
SAPINDACEAE	
Dodonaea viscosa Jacq subsp *spathulata*	1,4
D. pinifolia Miq	2–3
RHAMNACEAE	
Cryptandra nutans Steud	2–3
C. pungens Steud	2–3
Cryptandra sp (LWS 710)	3
STERCULIACEAE	
Thomasia foliosa Gay	2–3
DILLENIACEAE	
Hibbertia acerosa (R Br ex DC) Benth	2–3
H. exasperata (Steudel) Briq	4
H. rupicola (S Moore) C Gardner	2–3
STYLIDIACEAE	
Levenhookia dubia Sonder	1
L. pusilla R Br	1
Stylidium calcaratum R Br	1
S. ecorne (F Muell ex R Erickson & JH Willis) PG Farrell & SH James	1
S. petiolare Sonder	2–3
S. piliferum R Br	1
S. tenuicarpum Carlq	2–3
THYMELIACEAE	
Pimelea graniticola Rye	1
P. rosea R Br	2–3
MYRTACEAE	
Baeckea camphorosmae Endl	2–3
B. crispiflora F Muell	5
Baeckea sp Narrogin (R Hnatiuk 780011)	2–3
Calothamnus quadrifidus R Br	2–3
Calytrix leschenaultii (Schauer) Benth	2–3
Eucalyptus salmonophloia F Muell	5
E. rudis Endl	4 (N only)
E. wandoo Blakely	3,4,5
Kunzea pulchella (Lindley) AS George	1,2–3
K. recurva Schauer in Lehm	6
Leptospermum erubescens Schauer in Lehm	2–3
Leptospermum sp (LWS 838)	
Melaleuca pungens Schauer in Lehm	6
M. scabra R Br	5
M. undulata Benth	6
M. sp nov LWS 987 (*M. scabra* group)	5
Thryptomene australis Endl	1
Verticordia endlicheriana Schauer	2–3,6
V. grandiflora Endl	2–3,5
V. insignis Endl subsp *compta*	6
V. plumosa (Desf) Druce	6

HALORAGACEAE	
Glischrocaryon aureum (Lindley) Orch var *aureum*	1,2–3
Gonocarpus nodulosus Nees	1
APIACEAE	
Hydrocotyle sp	2–3
Trachymene ornata (Endl) Druce	1
T. pilosa Smith	2–3,1
EPACRIDACEAE	
Astroloma aff *drummondii* Sonder	2–3,5
A. pallidum R Br	5
Leucopogon dielsianus E Pritzel	4, 6
Lysinema ciliatum R Br	2–3,4
PRIMULACEAE	
**Anagallis arvensis* L	2–3
LOGANIACEAE	
Logania sp (JPP sn)	2–3
Mitrasacme paradoxa R Br	2–3
VERBENACEAE	
Halgania sp (JPP sn)	2–3
SOLANACEAE	
Nicotiana rotundifolia Lindl	1
SCROPHULARIACEAE	
**Parentucellia latifolia* (L) Caruel	2,3
MYOPORACEAE	
Eremophila aff *glabra* (LWS 729)	5
RUBIACEAE	
Opercularia vaginata Labill	2–3
GOODENIACEAE	
Dampiera alata Lindley	2–3
D. lavandulacea Lindl	5
D. lindleyi Vriese	2–3
Goodenia helmsii (E Pritz) Carolin	1
G. micrantha Hemsl ex Carolin	1, 2–3
G. pulchella Benth	1,2
Lechenaultia biloba Lindley	6
ASTERACEAE	
Brachycome ibiderifolia Benth	2–3,4,5
B. perpusilla (Steetz) J Black	1, 2–3
Gnephosis tenuissima Cass	2–3
Helichrysum leucopsideum DC	5
Helipterum laeve (AGray) Benth	5
Hyaospermum demissum (A Gray) PG Wilson	1
**Hypochaeris glabra* L	1,2–3,4
Lagenifera huegelii Benth in Endl	2–3
Podolepis canescans Cunn Ex DC	5
P. lessonii (Cass) Benth	2–3,5
Podotheca angustifolia (Labill) Less	2–3
Quinetia urvillei Cass	2–3
Rhodanthe manglesii Lindley	2–3
**Ursinia anthemoides* (L) Poiret	2–3,1,4
Waitzia acuminata Steetz	5
W. citrina (Benth) Steetz	2–3

Appendix 2

Lichen species, arranged by family, recorded at Yilliminning Rock near Narrogin, Western Australia

Family & species

ACAROSPORACEAE
- *Acarospora schleicheri* (Ach) Mass (syn *A. citrina*)

CLADIACEAE
- *Cladia aggregata* (Sw) Nyl
- *C. ferdinandii* (Mull Arg) R Filson

DICRANACEAE
- *Campylopus australis* Catches & Frahm
- *C. bicolor* (C. Muell.) Hook f & Wils

HETERODACEAE
- *Heterodea muelleri* (Hampe) Nyl

LECIDEACEAE
- *Lecidea laeta* Stirton
- *Lecidea* sp (N Sammy 840850)
- *Toninia* sp (N Sammy 840848)

PARMELIACEAE
- *Canoparmelia pruinata* (Mull Arg) Elix & Johnston
- *Flavoparmelia rutidota* (JD Hook & Taylor) Hale
- *Neofuscelia imitatrix* (Taylor) Esslinger
- *N. incantata* (Esslinger) Esslinger
- *N. pulla* (Ach) Esslinger
- *Paraparmelia sammyi* Elix & Johnston
- *P. sargentii* Elix & Johnston
- *Punctelia subalbicans* (Stirton) Galloway & Elix
- *Rhizocarpon* sp (N Sammy 840860)
- *Xanthoparmelia concomitans* Elix & Johnston
- *X. eilifii* Elix & Johnston
- *X. flavescentireagens* (Gyelnik) Galloway
- *X. notata* (Kurokawa) Hale
- *X. reptans* (Kurokawa) Elix & Johnston
- *X. substrigosa* (Hale) Hale
- *X. tasmanica* (JD Hook & Taylor) Hale

PHYSCIACEAE
- *Buellia* sp (N Sammy 840862)
- *P. tribacia* (Ach) Nyl
- *Physcia aipolia* (Ehrh ex Humb) Furnrohr

SIPHULACEAE
- *Siphula coriacea* Taylor ex Nyl

TELEOSCHISTACEAE
- *Caloplaca* sp (N Sammy 840861)

THELOTREMACEAE
- *Diploschistes australasicus* Lumbsch & Elix
- *Diploschistes* sp (JA Elix 41042)

VERRUCARIACEAE
- *Endocarpon* sp (N Sammy 840825, 840826, 840827)